Question:

A 723-N person stands on a uniform board of weight 282 N and length 6.1 m. The board is supported 1.00 meter in from the left end and 0.500 meters in from the right end. The support force 1.00 meters in from the left end is 683 N.

a) What is the support force 0.500 meters in from the right end?

b) How far from the left end of the board is the person standing?

Answer:

The system is in equilibrium so, the sum of all forces and total momentum are equal to zero. Let N_l is the support force 1.00 meter in from the left end, N_r is the support force 0.500 meters in from the right end, F_b is the weight of board, F_p is the weight of person and x is the distance from the left end of the board is the person standing. Now we have:

$$\begin{cases} N_l + N_r - F_b - F_p = 0 \\ N_l \cdot 1 + N_r \cdot (l - 0.5) - F_b \cdot \dfrac{l}{2} - F_p \cdot x = 0 \end{cases}$$

From first equation we can express N_r in terms of N_l, F_b, F_p:

$$\begin{cases} N_r = -N_l + F_b + F_p \\ N_l \cdot 1 + N_r \cdot (l - 0.5) - F_b \cdot \dfrac{l}{2} - F_p \cdot x = 0 \end{cases}$$

Now we can find N_r and x:

$$N_r = -N_l + F_b + F_p = -683 + 282 + 723 = 322 \ N;$$

$$x = \frac{N_l \cdot 1 + N_r \cdot (l - 0.5) - F_b \cdot \dfrac{l}{2}}{F_p} = 2.2491 \ m.$$